Exam

Name_____

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

1) In a local school, vending machines offer a range of drinks from juices to sports drinks. The purchasing agent thinks each type of drink is equally favored among the students buying drinks from the machines. The recent purchasing choices from the vending machines are shown in the table. 1) _____

Drink Type/Flavor	Lemon Lime Sports Drink	Kiwi Strawberry	Tropical Punch	Grape Sports Drink
Frequency	159	198	174	149

a. Test an appropriate hypothesis to decide if the purchasing agent is correct. Give statistical evidence to support your conclusion.
b. Which type of drink impacted your decision the most? Explain what this means in the context of the problem.

2) The vast majority of states and the District of Columbia have adopted the Common Core State Standards (CCSS) for math and English language arts. Do teachers support the CCSS? In March 2003, The American Federal of Teachers (AFT) asked AFT member teachers "Based on what you know about the Common Core State Standards and the expectations they set for children, do you approve or disapprove of your state's decision to adopt them? " The following results were reported in American Educator (Volume 32, No. 2, Summer 2013, pg. 3): 27% Strongly Approve; 48% Somewhat Approve; 14% Somewhat Disapprove; 8% Strongly Approve; 3% Not Sure. 2) _____
A district superintendent asked the same question to the teachers in her district to assess the level of teacher support for the CCSS within the district. She obtained the following results.

Response	Strongly Approve	Somewhat Approve	Somewhat Disapprove	Strongly Disapprove	Not Sure
Frequency	55	106	28	32	9

a. Test an appropriate hypothesis to ascertain if the district CCSS approval distribution matches the national AFT approval distribution.
b. Which response impacted your decision the most? Explain what this means in the context of the problem.

3) Could eye color be a warning signal for hearing loss in patients suffering from meningitis? British researcher Helen Cullington recorded the eye color of 130 deaf patients, and noted whether the patient's deafness had developed following treatment for meningitis. Her data are summarized in the table below. Test an appropriate hypothesis and state your conclusion. 3) _____

	Deafness related to…	
Eye color	meningitis	other
Light	30	72
Dark	2	26

4) A biology professor reports that historically grades in her introductory biology course have been distributed as follows: 15% A's, 30% B's, 40% C's, 10% D's, and 5% F's. Grades in her most recent course were distributed as follows: 4) _____

Grade	A	B	C	D	F
Frequency	89	121	78	25	12

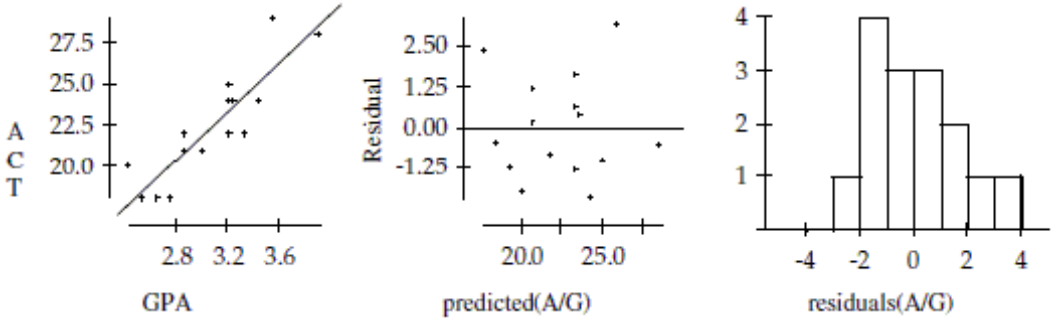
a. Test an appropriate hypothesis to decide if the professor's most recent grade distribution matches the historical distribution. Give statistical evidence to support your conclusion.
b. Which grade impacted your decision the most? Explain what this means in the context of the problem.

5) When two competing teams are equally matched, the probability that each team wins any game is 0.5. The NBA championship goes to the team that wins four games in a best-of-seven series. If the teams were equally matched, the probability that the final series ends with one of the teams sweeping four straight games would be $2(0.5)^4 = 0.125$. Further probability calculations indicate that 25% of these series should last five games, 31.25% should last six games, and the other 31.25% should last the full seven games. The table shows the number of games it took to decide each of the last 57 NBA champs. Do you think the teams are usually equally matched? Give statistical evidence to support your conclusion. 5) _____

Length of series	4 games	5 games	6 games	7 games
NBA finals	7	13	22	15

A high school counselor was interested in finding out how well student grade point averages (GPA) predict ACT scores. A sample of the senior class data was reviewed to obtain GPA and ACT scores. The data are shown in the table, and regression output is given below.

GPA	ACT
3.25	24
2.87	21
2.66	18
3.33	22
2.87	22
3.21	22
2.76	18
3.91	28
3.55	29
2.55	18
2.44	20
3.22	24
3.01	21
3.44	24
3.22	25



Dependent variable is: **ACT**
No Selector
R squared = 78.1% R squared (adjusted) = 76.4%
s = 1.630 with 15 - 2 = 13 degrees of freedom

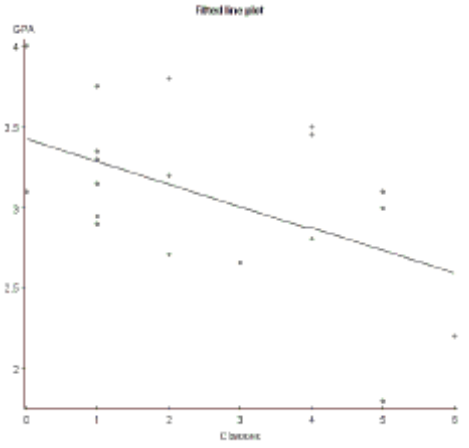
Source	Sum of Squares	df	Mean Square	F-ratio
Regression	123.041	1	123.041	46.3
Residual	34.5589	13	2.65838	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	-0.427035	3.382	-0.126	0.9014
GPA	7.39697	1.087	6.80	≤ 0.0001

6) Is there evidence of an association between GPA and ACT score? Test an appropriate hypothesis and state your conclusion in the proper context. 6) _____

A San Jose State student collects data from 20 students. He compares the number of classes a student is enrolled in to their GPA. Here are the results of the regression analysis. The conditions for inference are satisfied.

Simple linear regression results:
Dependent Variable: GPA
Sample size: 20
R-sq = 0.26753742
s: 0.45747



Coefficient	Estimate	Std. Err.	T-Stat	P-Value
Constant	3.4246	0.16580	20.654	<0.0001
No. of Classes	-0.13940	0.054369	-2.5641	0.0195

7) Find and interpret a 95% confidence interval for the slope of the regression equation. 7) _____

A college admissions counselor was interested in finding out how well high school grade point averages (HS GPA) predict first-year college GPAs (FY GPA). A random sample of data from first-year students was reviewed to obtain high school and first-year college GPAs. The data are shown below:

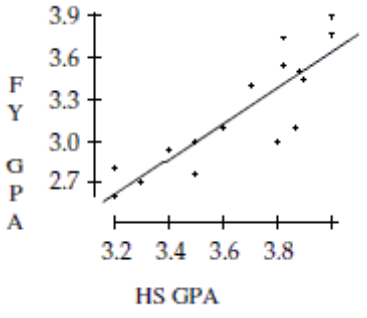
HS GPA	3.82	3.90	3.20	3.40	3.88	3.50	3.60	3.70
FY GPA	3.75	3.45	2.60	2.95	3.50	2.76	3.10	3.40

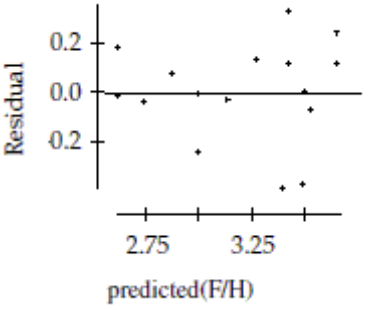
HS GPA	4.00	3.30	3.50	3.80	3.87	4.00	3.20	3.82
FY GPA	3.90	2.70	3.00	3.00	3.10	3.77	2.80	3.54

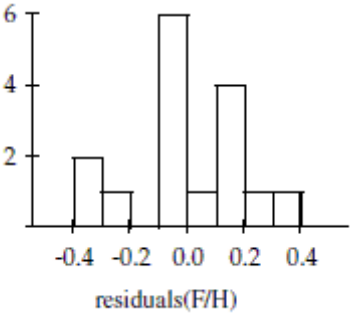
Dependent variable is: **FY GPA**
No Selector
R squared = 75.4% R squared (adjusted) = 73.6%
s = 0.2118 with 16 - 2 = 14 degrees of freedom

Source	Sum of Squares	df	Mean Square	F-ratio
Regression	1.92283	1	1.92283	42.9
Residual	0.627867	14	0.044848	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	-1.56410	0.7306	-2.14	0.0504
HS GPA	1.30527	0.1993	6.55	≤ 0.0001







8) Create and interpret a 95% confidence interval for the slope of the regression line. 8) _____

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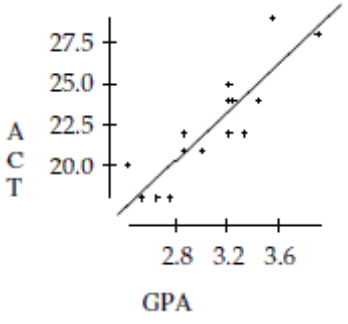

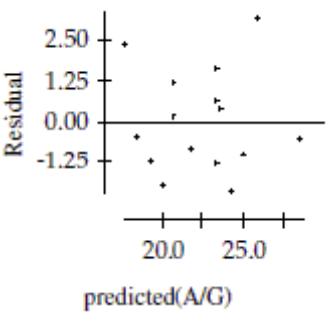

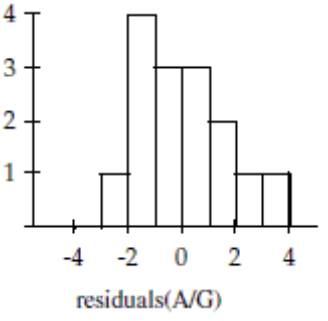

Dependent variable is: **ACT**
No Selector
R squared = 78.1% R squared (adjusted) = 76.4%
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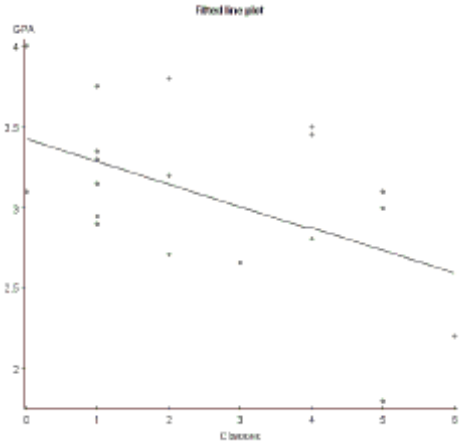
Source	Sum of Squares	df	Mean Square	F-ratio
Regression	123.041	1	123.041	46.3
Residual	34.5589	13	2.65838	

Variable	Coefficient	s.e. of Coeff	t-ratio	prob
Constant	-0.427035	3.382	-0.126	0.9014
GPA	7.39697	1.087	6.80	≤ 0.0001

9) Create and interpret a 95% confidence interval for the slope of the regression line. 9) _____

A San Jose State student collects data from 20 students. He compares the number of classes a student is enrolled in to their GPA. Here are the results of the regression analysis. The conditions for inference are satisfied.

Simple linear regression results:
Dependent Variable: GPA
Sample size: 20
R-sq = 0.26753742
s: 0.45747



Coefficient	Estimate	Std. Err.	T-Stat	P-Value
Constant	3.4246	0.16580	20.654	<0.0001
No. of Classes	-0.13940	0.054369	-2.5641	0.0195

10) Is there evidence of a significant relationship between number of classes and GPA? Provide statistical justification for your answer. 10) _____

11) Carnivores A random sample of some of the heaviest carnivores on Earth was reviewed to determine if there is an association between the length (in meters) and weight (in kilograms) of these carnivores. Here are the scatterplot, the residuals plot, a histogram of the residuals, and the regression analysis of the data. Use this information to analyze the association between the length and weight of these carnivores. 11) _____

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The regression equation is
Weight = - 668 + 485 Length

Predictor     Coef  SE Coef      T      P
Constant   -668.3    232.8  -2.87  0.024
Length     485.21    90.63   5.35  0.001

S = 194.794   R-Sq = 80.4%   R-Sq(adj) = 77.6%
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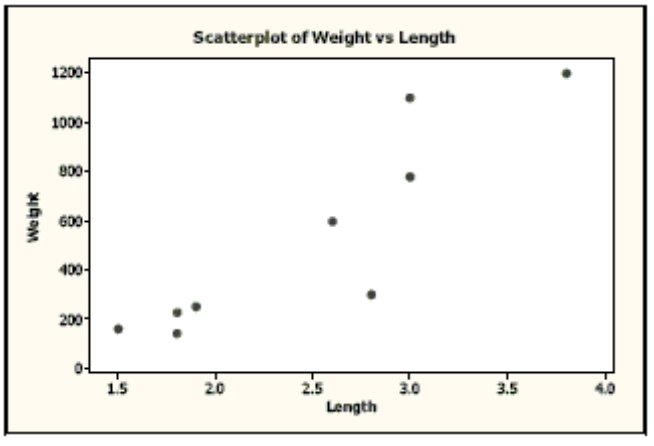
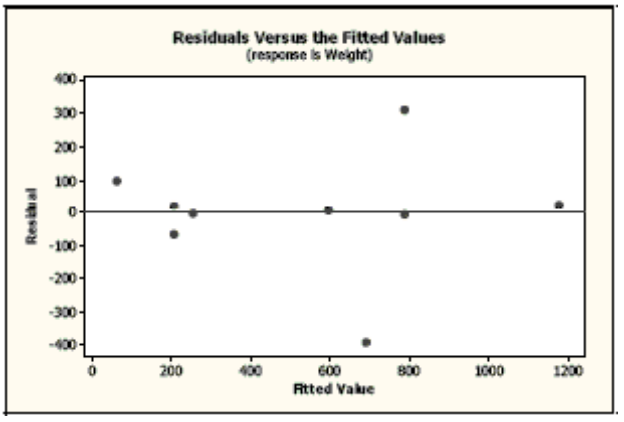
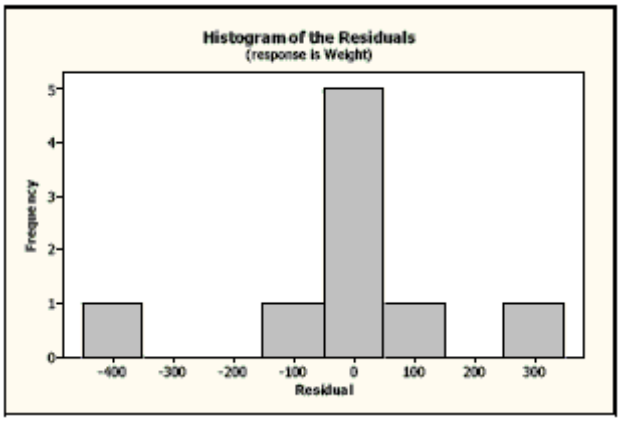


11)





a. Is there an association? Write appropriate hypotheses.
b. Are the assumptions for regression satisfied? Explain.
c. What do you conclude?
d. Create a 98% confidence interval for the true slope.
e. Explain in context what your interval means.

12) Wingspan A person's wingspan is the distance from fingertip to fingertip when their arms are fully extended. The longer a person's wingspan, the taller they tend to be. Regression analysis was executed on 24 individuals to see if height in inches can be used to predict wingspan (also in inches). The conditions for inference were deemed to be reasonably satisfied. 12) _____

Dependent Variable: Wingspan
Sample size: 24
R-sq = 0.8026696
s: 2.1512606

Coefficient	Estimate	Std. Err.	T-Stat	P-Value
Constant	-13.024544	8.5719795	-1.5194324	0.1429
Height	1.1909246	0.125893	9.459816	<0.0001

a. Write the equation of the regression line. Make sure to define all the variables in your equation.
b. Interpret the slope of the regression equation in context.
c. Interpret the value of s in context.
d. Find and interpret a 95% confidence interval for slope.
e. Is the relationship between wingspan and height a strong relationship? Why? Give two reasons to justify your answer.

13) Facebook In 2012, the Pew Research Center asked a random sample of Facebook users about their habits with this social media tool. One of the questions asked was about the plans people had for spending time on Facebook in the coming year. They were asked if they planned to more time, less time, or about the same time as now. Respondents were also broken into three age groups. Do these data provide evidence that age is independent of plans for Facebook time? Provide statistical justification for your answer. (www.pewinternet.org) 13) _____

	More time	Less time	Same time as now
18-29	85	124	153
30-49	53	46	33
50+	1	9	10

MULTIPLE CHOICE. Choose the one alternative that best completes the statement or answers the question.

14) Several volunteers engage in a special exercise program intended to lower their blood pressure. We measure each person's initial blood pressure, lead them through the exercises daily for a month, then check blood pressures again. To see if the program lowered blood pressure significantly we should do a 14) _____

A) 2-sample *t*-test
B) χ^2 goodness-of-fit test
C) χ^2 test of homogeneity
D) matched pairs *t*-test
E) linear regression *t*-test

SHORT ANSWER. Write the word or phrase that best completes each statement or answers the question.

15) Cloning A random sample of 800 adults was asked the following question: "*Do you think current laws concerning the use of cloning for medical research are too strict, too lenient, or about right?*" The pollsters also classified the respondents with respect to highest education level attained: high school, 2-year college degree, 4-year degree, or advanced degree. We wish to know if attitudes on cloning are related to education level. (All the conditions are satisfied - don't worry about checking them.) 15) _____

	Strict	Lenient	Right	Total
High school	93	107	182	382
	106.01	87.38	188.61	
2-year	27	19	56	102
	28.31	23.33	50.36	
4-year	82	50	140	272
	75.48	62.22	134.30	
Adv. degree	20	7	17	44
	12.21	10.07	21.73	
Total	222	183	395	800

$\chi^2 =$ 1.60 + 4.40 + 0.23 +
0.06 + 0.80 + 0.63 +
0.56 + 2.40 + 0.24 +
4.97 + 0.93 + 1.03 = 17.86

P = 0.0066

a. Write appropriate hypotheses.
b. Suppose the expected counts had not been given. Show how to calculate the expected count in the first cell (106.01).
c. How many degrees of freedom?
d. State your complete conclusion in context.